

WHAT IS CLAIMED IS:

1. A method including:  
detecting, in a subject, a condition correlative to hypotension; and  
adjusting, in response to the detected condition, a rate response factor  
relating: (a) a pacing rate at which stimulations are delivered to the subject's heart;  
to (b) a sensor signal that is correlative to the subject's metabolic need for cardiac  
output.
2. The method of claim 1, in which the detecting the condition correlative to  
hypotension includes detecting a thoracic impedance signal associated with a portion  
of the subject's thorax.
3. The method of claim 2, in which the detecting the thoracic impedance signal  
includes detecting a component of the thoracic impedance associated with a fluid  
shift away from the thorax.
4. The method of claim 3, in which detecting the component of the thoracic  
impedance associated with a fluid shift away from the thorax includes detecting an  
increase in a baseline portion of the thoracic impedance.
5. The method of claim 4, in which the baseline portion of the thoracic  
impedance is less than or equal to a cutoff frequency value that is between 0.01 Hz  
and 0.5 Hz inclusive.
6. The method of claim 5, in which the cutoff frequency value is approximately  
0.1 Hz.

7. The method of claim 2, further including attenuating a high frequency component of the thoracic impedance signal.
8. The method of claim 2, in which detecting the activity signal includes a detecting selected from a group consisting essentially of:
- detecting an acceleration signal correlative to the subject's activity; and
  - detecting a breathing signal correlative to the subject's activity.
9. The method of claim 2, in which the detecting the activity signal includes:
- detecting a substantially instantaneous component of the activity signal;
  - detecting a long-term component of the activity signal;
  - comparing the substantially instantaneous and long-term components of the activity signal; and
  - deeming the detected condition to be correlative to hypotension when a first signal magnitude from the substantially instantaneous component of the activity signal exceeds a first threshold and a second threshold exceeds a second signal magnitude from the long-term component of the activity signal.
10. The method of claim 1, in which the detecting the condition correlative to hypotension includes detecting an activity signal correlative to the subject's activity
11. The method of claim 1, in which the detecting the condition correlative to hypotension includes detecting a condition correlative both to a hypotension associated with a change in a subject's posture and to a hypotension that is not associated with a change in the subject's posture.
12. The method of claim 1, in which detecting the condition correlative to hypotension includes detecting a condition correlative to a hypotension associated with a change in a subject's posture, but substantially not correlative to a

hypotension not associated with a change in a subject's posture.

**13.** The method of claim **1**, in which adjusting the rate response factor includes increasing the rate response factor, in response to the detecting the condition correlative to hypotension, such that a particular sensor indication of metabolic need results in a higher pacing rate after the increasing the rate response factor as compared to before the increasing the rate response factor.

**14.** The method of claim **13**, in which the increasing the rate response factor includes stepping the rate response factor, in response to the detecting the condition correlative to hypotension, from a first value to a second value for a first predetermined time period, and further including then stepping the rate response factor from the second value to the first value.

**15.** The method of claim **13**, in which the increasing the rate response factor includes stepping the rate response factor, in response to the detecting the condition correlative to hypotension, from a first value to a second value for a second predetermined time period, and further including then more gradually decreasing the rate response factor.

**16.** The method of claim **15**, in which the more gradually decreasing the rate response factor includes returning the rate response factor to the first value over a third predetermined time period.

**17.** A cardiac rhythm management system, including:

a hypotension condition detection circuit to detect a hypotension condition in a subject and to provide a hypotension detection indicator;

a first sensor to provide a first sensor signal correlative to the subject's metabolic need for a cardiac output;

a pacing therapy output circuit to provide therapy to the subject at an indicated rate;

a controller, coupled to provide the indicated rate to the pacing therapy output circuit, the controller also coupled to the hypotension condition detection circuit to receive the hypotension detection indicator, the controller also coupled to the first sensor to receive the first sensor signal, and in which the controller determines the indicated rate based at least in part on the first sensor signal, the controller including a rate response factor to relate a component of the first sensor signal to the indicated rate, the rate response factor being adjusted by the controller in response to the hypotension condition indicator.

**18.** The system of claim **17**, in which the hypotension condition detection circuit includes a thoracic impedance detection circuit to receive a thoracic impedance signal from the subject, a baseline component of the thoracic impedance signal associated with a fluid shift away from the thorax corresponding to the hypotension condition.

**19.** The system of claim **18**, in which the thoracic impedance detection circuit further includes first and second electrodes configured for association with a portion of the subject's thorax.

**20.** The system of claim **18**, in which the thoracic impedance detection circuit further includes an averager/lowpass filter to obtain the baseline portion of the thoracic impedance signal associated with the fluid shift and to attenuate a portion of the thoracic impedance signal not associated with the fluid shift.

**21.** The system of claim **20**, in which the averager/lowpass filter includes an effective cutoff frequency that is between 0.01 Hz and 0.5 Hz.

22. The system of claim 21, in which the lowpass filter includes a cutoff frequency that is approximately equal to 0.1 Hz.

23. The system of claim 17, in which the hypotension condition detection circuit includes an activity sensing circuit to provide an activity signal correlative of the subject's activity from which the hypotension condition is determinable.

24. The system of claim 23, in which the activity sensing circuit includes a respiration detection circuit to sense the subject's breathing.

25. The system of claim 23, in which the activity sensing circuit includes an acceleration sensing circuit to sense an acceleration associated with the subject's activity.

26. The system of claim 23, in which the activity sensing circuit includes:  
a first signal processing circuit to provide a substantially instantaneous component of the activity signal;  
a second signal processing circuit to provide a long-term component of the activity signal;  
a comparison circuit, to compare the substantially instantaneous and long-term components of the activity signal and to deem the detected condition to be correlative to hypotension when a first signal magnitude from the substantially instantaneous component of the activity signal exceeds a first threshold and a second threshold exceeds a second signal magnitude from the long-term component of the activity signal.

27. The system of claim 17, in which the controller adjusts the rate response factor by increasing the rate response factor in response to the hypotension detection indicator indicating a hypotension condition, such that a particular sensor indication

of metabolic need results in a higher pacing rate after the increasing the rate response factor as compared to before the increasing the rate response factor.

**28.** The method of claim **27**, in which the controller steps the rate response factor, in response to the hypotension detection indicator indicating a hypotension condition, from a first value to a second value for a first predetermined time period, and further including then stepping the rate response factor from the second value to the first value after the first predetermined time period.

**29.** The method of claim **27**, in which the controller steps the rate response factor, in response to the hypotension detection indicator indicating a hypotension condition, from a first value to a second value for a second predetermined time period, and the controller then more gradually decreases the rate response factor.

**30.** The method of claim **29**, in which the controller more gradually decreases the rate response factor by returning the rate response factor to the first value over a third predetermined time period.

**31.** A cardiac rhythm management system, including:

means for detecting a hypotension in a subject and providing a responsive hypotension detection indicator;

a first sensor to provide a first sensor signal correlative to the subject's metabolic need for a cardiac output;

a pacing therapy output circuit to provide therapy to the subject at an indicated rate;

a controller, coupled to provide the indicated rate to the pacing therapy output circuit, the controller also coupled to the means for detecting the hypotension to receive the hypotension detection indicator, the controller also coupled to the first sensor to receive the first sensor signal, and in which the controller determines the

indicated rate based at least in part on the first sensor signal, the controller including a rate response factor to relate a component of the first sensor signal to the indicated rate, the rate response factor being adjusted by the controller in response to the hypotension condition indicator.

**32.** The system of claim **31**, in which the means for detecting the hypotension includes a means for detecting thoracic impedance.

**33.** The system of claim **31**, in which the means for detecting the hypotension includes a means for sensing activity of the subject.

**34.** The system of claim **33**, in which the means for sensing activity includes a means for sensing the subject's breathing associated with the subject's activity.

**35.** The system of claim **33**, in which the means for sensing activity includes a means for sensing an acceleration associated with the subject's activity.